WHAT IS CLAIMED IS:

[c01] 1. A flexible liquid crystal display, said flexible liquid crystal display comprising:

a) two plates, said two plates being substantially parallel to each other, wherein each of said plates comprises: a polymeric substrate, said polymeric substrate having a roughness of up to about 5 nm; a barrier coating disposed on a surface of said polymeric substrate; and a transparent conductive layer disposed on a surface of said barrier coating opposite said polymeric substrate; and

b) a liquid crystal material, said liquid crystal material being disposed between said two plates, such that said liquid crystal material contacts said transparent conductive layer on each of said two plates.

[c02] 2. The flexible liquid crystal display of Claim 1, wherein each of said plates has an oxygen permeation rate of no greater than about 0.1 cm^3/m^2-day.

[c03] 3. The flexible liquid crystal display of Claim 2, wherein each of said plates has a water vapor transmission rate of no greater than about 1.0 g/m^2-day.

[c04] 4. The flexible liquid crystal display of Claim 1, wherein said polymeric substrate is a polycarbonate substrate.

[c05] 5. The flexible liquid crystal display of Claim 1, wherein said liquid crystal material is a liquid crystal material selected from the group consisting of nematic liquid crystals, thermochromic liquid crystals, liotropic liquid crystals, ferroelectric liquid crystals, twisted nematic liquid crystals, super twisted nematic liquid crystals, and polymer-dispersed liquid crystals.

[c06] 6. The flexible liquid crystal display of Claim 1, wherein said polymeric substrate has a glass transition temperature of at least about 150°C.

[c07] 7. The flexible liquid crystal display of Claim 6, wherein said polymeric substrate has a glass transition temperature of at least about 250°C.

[c08] 8. The flexible liquid crystal display of Claim 1, wherein said polymeric substrate has a thickness of between about 12 microns and about 3 mm.

[c09] 9. The flexible liquid crystal display of Claim 1, wherein said polymeric substrate is formed under class 1000 clean room conditions.

[c10] 10. The flexible liquid crystal display of Claim 1, wherein said barrier coating is deposited by a technique selected from the group consisting of plasma enhanced chemical vapor deposition, ion beam assisted deposition, sputtering, thermal evaporation, electron beam evaporation, high intensity plasma chemical vapor deposition, and combinations thereof.

[c11] 11. The flexible liquid crystal display of Claim 1, wherein said barrier coating has a density of at least 1.8 g/cm^3.

[c12] 12. The flexible liquid crystal display of Claim 1, wherein said barrier coating comprises at least one compound selected from the group consisting of silicon nitride, silicon oxide, aluminum oxide, and combinations thereof.

[c13] 13. The flexible liquid crystal display of Claim 12, wherein said barrier coating comprises silicon nitride.

[c14] 14. The flexible liquid crystal display of Claim 12, wherein said barrier coating comprises silicon oxide.

[c15] 15. The flexible liquid crystal display of Claim 1, wherein said barrier coating has a thickness of between about 10 nm and about 1000 nm.

[c16] 16. The flexible liquid crystal display of Claim 1, wherein said transparent conductive layer has a sheet resistance of up to about 30 Ω per square.

[c17] 17. The flexible liquid crystal display of Claim 1, wherein said transparent conductive layer comprises an oxide of at least one metal selected from the group consisting of tin, cadmium, indium, zinc, magnesium, gallium, and combinations thereof.

[c18] 18. The flexible liquid crystal display of Claim 17, wherein said transparent conductive layer further comprises at least one dopant selected from the group consisting of gallium, aluminum, germanium, and tin.

[c19] 19. The flexible liquid crystal display of Claim 17, wherein said oxide is indium tin oxide.

[c20] 20. The flexible liquid crystal display of Claim 1, wherein said transparent conductive layer comprises at least one metal selected from the group consisting of aluminum, copper, platinum, palladium, and alloys thereof.

[c21] 21. The flexible liquid crystal display of Claim 1, wherein said transparent conductive layer has a thickness of between about 20 nm and about 200 nm.

[c22] 22. A barrier coated polymer sheet for use in a liquid crystal display, said barrier coated polymer sheet comprising:

a) a polycarbonate substrate, said polycarbonate substrate having a roughness of up to about 5 nm; and

b) a barrier coating disposed on a surface of said polycarbonate substrate, said barrier coating having a density of at least 1.8 g/cm^3.

[c23] 23. The barrier coated polymer sheet of Claim 22, wherein said barrier coating is deposited by plasma enhanced chemical vapor deposition.

[c24] 24. The barrier coated polymer sheet of Claim 22, wherein said barrier coating comprises at least one compound selected from the group consisting of silicon nitride, silicon oxide, aluminum oxide, and combinations thereof.

[c25] 25. The barrier coated polymer sheet of Claim 24, wherein said barrier coating comprises silicon nitride.

[c26] 26. The barrier coated polymer sheet of Claim 24, wherein said barrier coating comprises silicon oxide.

[c27] 27. The barrier coated polymer sheet of Claim 24, wherein said barrier coating has a thickness of between about 10 nm and about 1000 nm.

[c28] 28. A flexible liquid crystal display, said flexible liquid crystal display comprising:

a) two plates, said two plates being substantially parallel to each other, wherein each of said plates comprises: a polycarbonate substrate, said polycarbonate substrate having a roughness of up to about 5 nm; a barrier coating disposed on a surface of said polycarbonate substrate; and a transparent conductive layer disposed on a surface of said barrier coating opposite said polycarbonate substrate; and

b) a liquid crystal material, said liquid crystal material being disposed between said two plates, such that said liquid crystal material contacts said transparent conductive layer on each of said two plates,

wherein each of said plates has an oxygen permeation rate of no greater than about 0.1 cm^3/m^2-day and a water vapor transmission rate of no greater than about 1.0 g/m^2-day.

[c29] 29. The flexible liquid crystal display of Claim 28, wherein said liquid crystal material is a liquid crystal material selected from the group consisting of nematic liquid crystals, thermochromic liquid crystals, liotropic liquid crystals, ferroelectric liquid crystals, twisted nematic liquid crystals, super twisted nematic liquid crystals, and polymer-dispersed liquid crystals.

[c30] 30. The flexible liquid crystal display of Claim 28, wherein said polycarbonate substrate has a glass transition temperature of at least about 150°C.

[c31] 31. The flexible liquid crystal display of Claim 28, wherein said polycarbonate substrate has a glass transition temperature of at least about 250°C.

[c32] 32. The flexible liquid crystal display of Claim 28, wherein said polycarbonate substrate has a thickness of between about 12 microns and about 3 mm.

[c33] 33. The flexible liquid crystal display of Claim 28 wherein said polycarbonate substrate is formed under class 1000 clean room conditions.

[c34] 34. The flexible liquid crystal display of Claim 28, wherein said barrier coating is deposited by a technique selected from the group consisting of plasma enhanced chemical vapor deposition, ion beam assisted deposition, sputtering, thermal evaporation, electron beam evaporation, high intensity plasma chemical vapor deposition, and combinations thereof.

[c35] 35. The flexible liquid crystal display of Claim 28, wherein said barrier coating comprises at least one compound selected from the group consisting of silicon nitride, silicon oxide, aluminum oxide, and combinations thereof.

[c36] 36. The flexible liquid crystal display of Claim 35, wherein said barrier coating comprises silicon nitride.

[c37] 37. The flexible liquid crystal display of Claim 35, wherein said barrier coating comprises silicon oxide.

[c38] 38. The flexible liquid crystal display of Claim 27, wherein said barrier coating has a thickness of between about 10 nm and about 1000 nm.

[c39] 39. The flexible liquid crystal display of Claim 28, wherein said transparent conductive layer has a sheet resistance of up to about 30 Ω per square.

[c40] 40. The flexible liquid crystal display of Claim 28, wherein said transparent conductive layer comprises an oxide of at least one metal selected from the group consisting of tin, cadmium, indium, zinc, magnesium, gallium, and combinations thereof.

[c41] 41. The flexible liquid crystal display of Claim 40, wherein said oxide is indium tin oxide.

[c42] 42. The flexible liquid crystal display of Claim 40, wherein said transparent conductive layer further comprises at least one dopant selected from the group consisting of gallium, aluminum, germanium, and tin.

[c43] 43. The flexible liquid crystal display of Claim 28, wherein said transparent conductive layer comprises at least one metal selected from the group consisting of aluminum, copper, platinum, palladium, and alloys thereof.

[c44] 44. The flexible liquid crystal display of Claim 28, wherein said transparent conductive layer has a thickness of between about 20 nm and about 200 nm.

[c45] 45. The flexible liquid crystal display of Claim 28, wherein said transparent conductive layer is deposited by a technique selected from the group consisting of plasma enhanced chemical vapor deposition, ion beam assisted deposition, sputtering, thermal evaporation, electron beam evaporation, high intensity plasma chemical vapor deposition, and combinations thereof.

[c46] 46. A method of making a barrier coated polymer sheet for use in a liquid crystal display, said barrier coated polymer sheet comprising a polycarbonate substrate having a roughness of less than about 5 nm and a barrier coating disposed on a surface of the polycarbonate substrate, the barrier coating having a density of at least 1.8 g/ cm^3, the method comprising the steps of:

a) providing the polycarbonate substrate; and

b) depositing the barrier coating on the surface of the polycarbonate substrate by plasma enhanced chemical vapor deposition.

[c47] 47. The method of Claim 46, wherein the step of depositing the barrier coating on the surface of the polycarbonate substrate by plasma enhanced chemical vapor deposition comprises depositing at least one of silicon nitride, silicon oxide, and aluminum oxide on the surface of the polycarbonate substrate by plasma enhanced chemical vapor deposition.

[c48] 48. The method of Claim 46, further comprising the step of depositing a transparent conducting layer onto the barrier layer.

[c49] 49. The method of Claim 48, wherein the step of step of depositing a transparent conducting layer on the barrier layer comprises depositing a transparent conducting oxide layer onto the barrier layer.

[c50] 50. The method of Claim 48, wherein the step of step of depositing a transparent conducting layer on the barrier layer comprises sputtering the transparent conducting layer onto the barrier layer.

[c51] 51. An apparatus for coating a continuous sheet of polymeric substrate with a barrier layer, the apparatus comprising:

a) a rotatable drum contacting a first surface of said sheet, sheet, wherein said rotatable drum and said sheet are heatable to a predetermined temperature;

b) a substrate supply for supplying a continuous feed of said sheet to said rotatable drum;

c) at least one barrier layer deposition device for depositing said barrier layer, said barrier layer comprising at least one of silicon nitride, silicon oxide, aluminum oxide, and combinations thereof on a second surface of said sheet;

d) a sheet collection device for collecting said sheet after sheet has contacted said rotatable drum and said barrier layer has been deposited on said sheet; and

e) a vacuum chamber for maintaining said rotatable drum, said substrate supply, said deposition device, and said sheet collection device at a predetermined pressure, said vacuum chamber enclosing said rotatable drum, said substrate supply, said barrier layer deposition device, and said sheet collection device, wherein said vacuum chamber is in communication to a pumping system.

[c52] 52. The apparatus of Claim 51, wherein said substrate supply is a rotatable payout reel.

[c53] 53. The apparatus of Claim 51, wherein said sheet collection device is a rotatable take-up reel.

[c54] 54. The apparatus of Claim 51, further comprising a first guiding device for guiding said sheet from said substrate supply to said rotatable drum.

[c55] 55. The apparatus of Claim 54, further comprising a second guiding device for guiding said sheet from said rotatable drum supply to said sheet collection device.

[c56] 56. The apparatus of Claim 55, wherein each of said first guiding device and said second guiding device comprise at least one roller.

[c57] 57. The apparatus of Claim 51, wherein said barrier layer deposition device is a selected from the group consisting of a plasma enhanced chemical vapor deposition device, an ion beam assisted device, a sputtering device, a thermal evaporation device, an electron beam evaporation device, a high intensity plasma chemical vapor deposition device, and combinations thereof.

[c58] 58. The apparatus of Claim 51, further comprising a conductive layer deposition device for depositing a conductive layer on a surface of said barrier layer opposite said polymeric substrate.

[c59] 59. The apparatus of Claim 58, wherein said conductive layer deposition device is selected from the group consisting of a plasma enhanced chemical vapor deposition device, an ion beam assisted device, a sputtering device, a thermal evaporation device, an electron beam evaporation device, and combinations thereof.